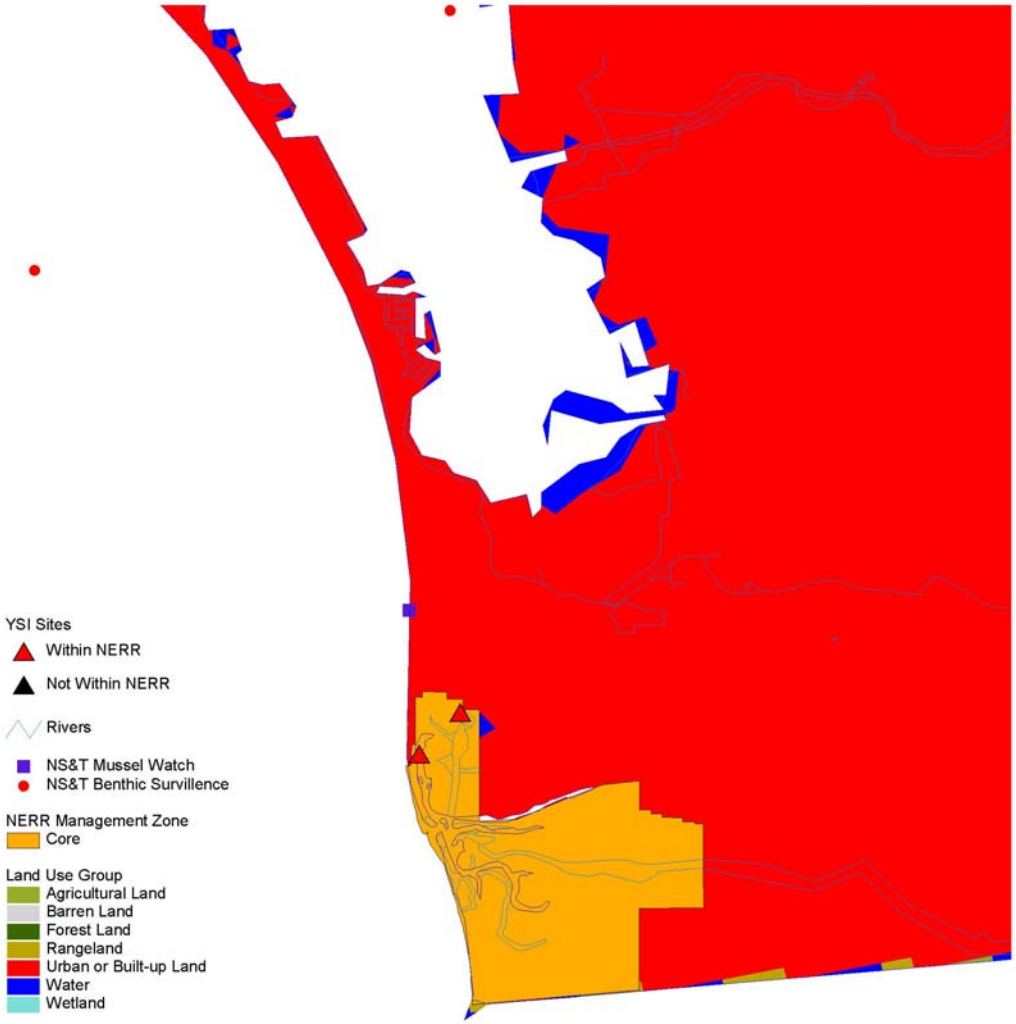
Tijuana River



Tijuana River, Oneonta Slough (TJROS)

Characterization (Latitude = 32° 34' N; Longitude = 117° 09'W)
Tides at Oneonta Slough are semidiurnal and range from 2.3 m to –0.5 m. Oneonta Slough is 2 km long (mainstream linear dimension), has an average depth of 2 m MHW, and an average width of 20 m. At the sampling site, the water depth is 2 m MHW and the width is 20 m. Approximately 2/3 of the watershed is in Mexico. Creek bottom habitats are sand, with sparse bottom vegetation. The dominant marsh vegetation near the sampling site includes common pickleweed and Pacific cordgrass. The dominant upland vegetation includes maritime succulent scrub and inland sage scrub. Upland land use near the sampling site includes military airfields to the northeast and residential developments. Activities that potentially impact the site include storm drain runoff from a military airfield and adjacent residential areas, and occasional sewage spills (10-15 MGD) into the Tijuana River from Mexico.

Descriptive Statistics
Sixty-eight deployments were made at this site between Jan 1996 and Dec 1998, with equal coverage during all seasons, except Oct 1997 (Figure 32). Mean deployment duration was 13.3 days. Only three deployments (Jun, Oct 1996 and Nov 1998) were less than 10 days.

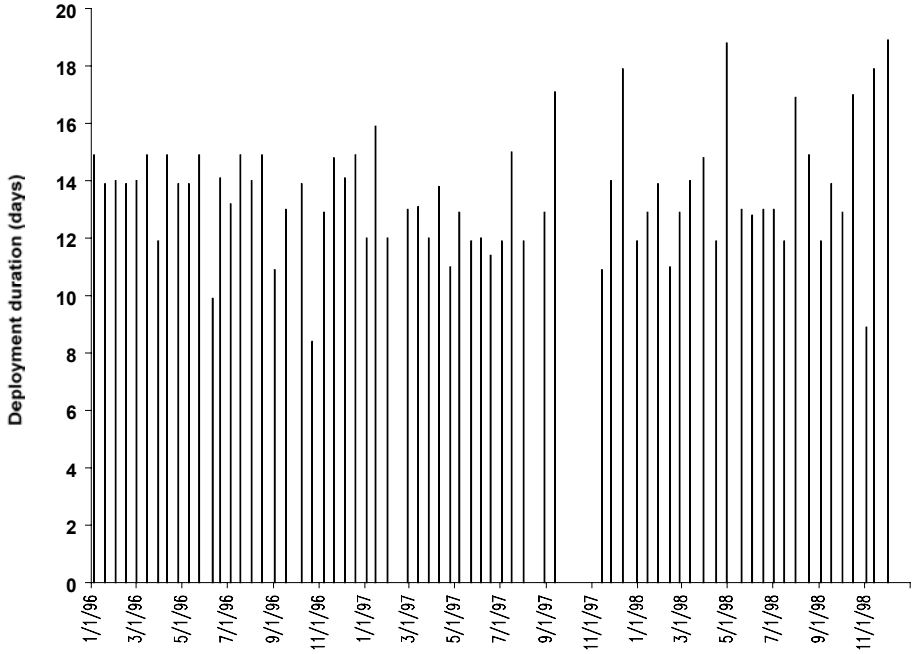


Figure 32. Tijuana River Estuary, Oneonta Slough deployments (1996-1998).

Eighty-three percent of annual depth data were included in analyses (87% in 1996, 71% in 1997, and 90% in 1998). Sensors were deployed at a mean depth of 0.8 m below the water surface and 0.3 m above the bottom sediment. Scatter plots suggest moderate fluctuations (0.75-1.25 m) in depth which gradually increased and decreased with an approximate 6 month periodicity (increase for three months, decrease for three months). Harmonic regression analysis attributed 56% of depth variance to interaction between 12.42 hour and 24 hour cycles, 21% of depth variance to 24 hour cycles, and 23% of depth variance to 12.42 hour cycles.

Eighty-four percent of annual water temperature data were included in analyses (91% in 1996, 71% in 1997, and 90% in 1998). Mean water temperature followed a seasonal cycle; however, large variances were associated with mean values throughout the data set (Figure 33). Mean water temperatures were 14-15°C in winter and 21-23°C in summer. Minimum and maximum water temperatures between 1996-1998 were 7.5°C (Dec 1996, 1998) and 30.3°C (Aug 1996), respectively. Scatter plots suggest strong and abrupt fluctuations (4-10°C, occasionally >10°C) in both daily and bi-weekly temperature, with strongest fluctuations observed in spring and summer. Harmonic regression analysis attributed 72% of temperature variance to interaction between 12.42 hour and 24 hour cycles, 20% of variance to 24 hour cycles, and 8% of variance to 12.42 hour cycles.

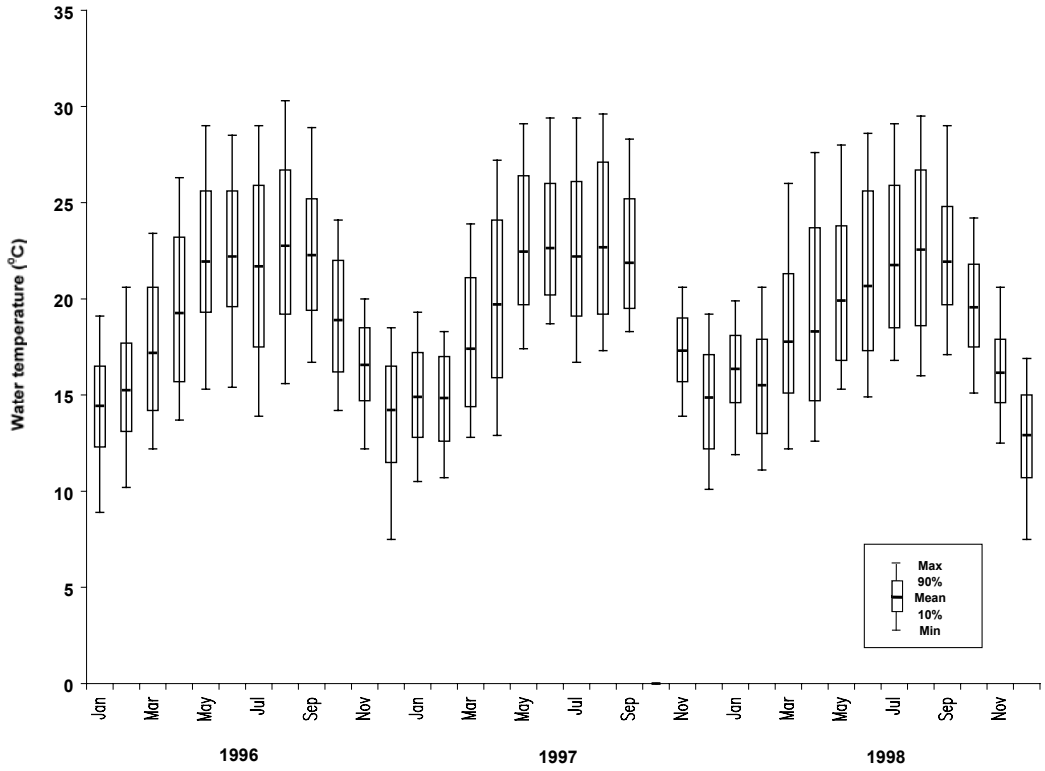


Figure 33. Water temperature statistics at Oneonta Slough, 1996-1998.

Eighty-two percent of annual salinity data were included in analyses (87% in 1996, 71% in 1997, and 90% in 1998). Mean salinity followed a seasonal cycle in 1996 and 1998; however, large variances were associated with mean salinity in winter and spring (Figure 34). Mean salinity was greatest in summer and least in winter. Mean summer salinity was greater in 1996 (35-36 ppt) than in 1997-1998 (30-31 ppt). Mean winter salinity in 1996 and 1997 were similar (28-32 ppt) and substantially less variable than mean winter salinity in 1998 (14-28 ppt). Minimum and maximum salinity between 1996-1998 was 0.3 ppt (Feb 1998) and 40.2 ppt (Sep 1996), respectively. Scatter plots suggest moderate fluctuations (≤ 5 ppt) in daily and bi-weekly salinity, with strong fluctuations (≥ 15 ppt) observed during episodic events in 1996 (Feb, Mar, Nov), 1997 (Jan, Sep, Dec), and 1998 (Jan-May). Harmonic regression analysis attributed 51% of salinity variance to interaction between 12.42 hour and 24 hour cycles, 19% of variance to 12.42 hour cycles, and 30% of variance to 24 hour cycles.

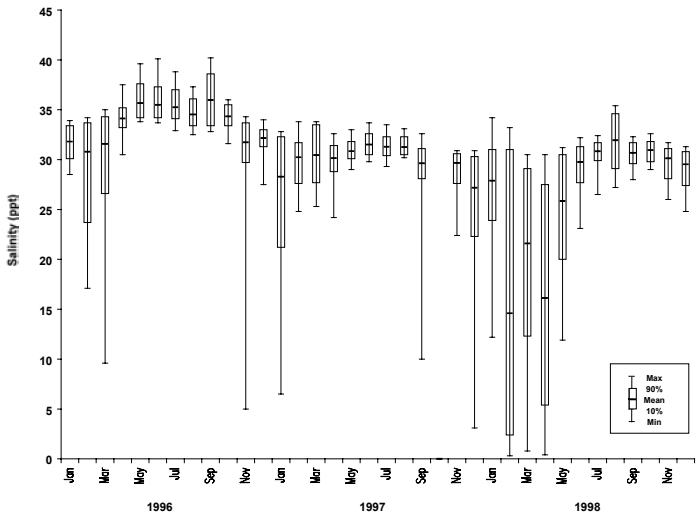


Figure 34. Salinity statistics at Oneonta Slough, 1996-1998.

Seventy-two percent of annual dissolved oxygen (% saturation) data were included in analyses (76% in 1996, 58% in 1997, and 80% in 1998). Mean DO ranged from 34-103% saturation and followed a seasonal cycle, with greatest DO in fall/winter and least in spring/summer. Minimum DO regularly approached 0% saturation in spring and summer 1996-1998 and in fall 1998. Maximum DO was typically < 200% saturation, except for Mar-Jun 1998 when maximum DO ranged from 300-450% saturation. Hypoxia was regularly observed between 1996-1998 and, when present, hypoxia persisted for 18% of the first 48 hours post-deployment on average (Figure 35). Supersaturation was infrequently observed in 1996 and 1997, but regularly observed in 1998. When present, supersaturation persisted 11.5% of the first 48 hours post-deployment on average. Scatter plots suggest strong fluctuations (≥ 80%) in percent saturation throughout the data set, with fluctuations > 400% saturation observed in May-Jun 1998. Harmonic regression analysis attributed 61% of DO variance to interaction between 12.42 hour and 24 hour cycles, 29% of DO variance to 24 hour cycles, and 10% of DO variance to 12.42 hour cycles.

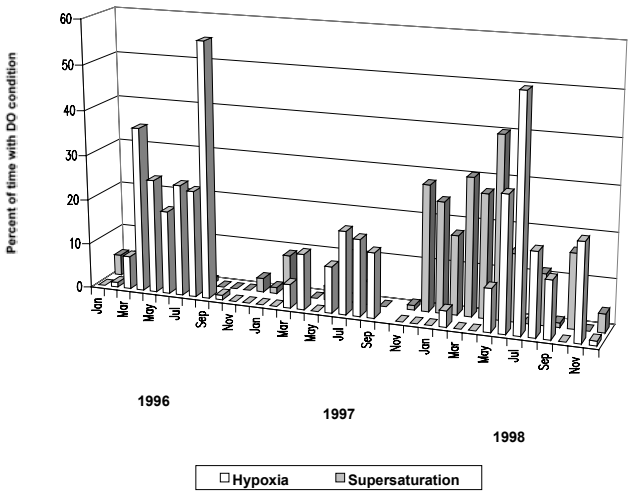


Figure 35. Dissolved oxygen extremes at Oneonta Slough, 1996-1998.

Tijuana River, Tidal Linkage (TJRTL)

Characterization (Latitude = 32°34'N; Longitude =117°09'W)
Tides at the tidal linkage site are semidiurnal and range from 2.3 m to -0.5 m. The Tijuana River is 2 km long (mainstream linear dimension), has an average depth of 2 m at MHW, and an average width of 5 m. The Tidal Linkage site is located in an artificial channel (3 m wide, 400 m long, with average depth 2 m at MHW) that was last dredged out in 1998. At the sampling site the depth is 2 m MHW and the width is 20 m. Creek bottom habitats are predominantly sand and mud with sparse bottom vegetation. The dominant upland vegetation includes maritime succulent scrub and inland sage scrub. Upland land use near the sampling site military airfields, and residential developments.

Descriptive Statistics
Thirty-three deployments were made at this site between May 1997 and Dec 1998, with equal coverage during all months, except Sep 1997 (Figure 36). Mean deployment duration was 13.5 days. Only two deployments (Apr, Nov 1998) were less than 10 days.

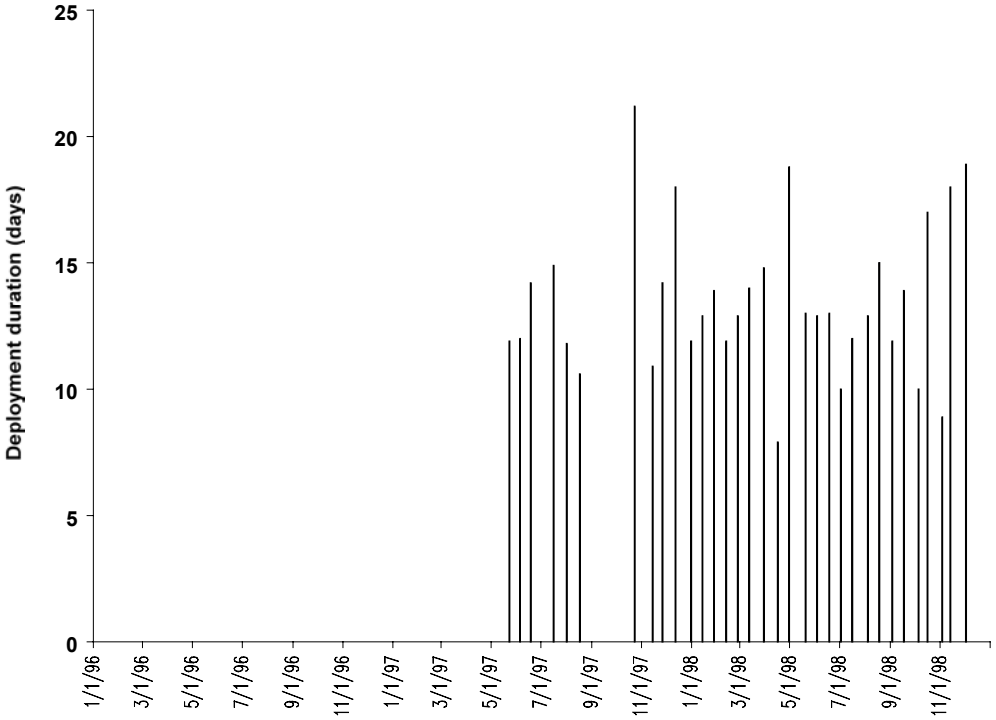


Figure 36. Tijuana River Estuary, Tidal Linkage deployments (1996-1998).

Thirty-five percent of annual depth data in 1997 and 85% of annual depth data in 1998 (85%) were included in analyses. Sensors were deployed at a mean depth of 0.4 m below the water surface and 0.3 m above the bottom sediment. Scatter plots suggest moderate fluctuations (≤ 1 m) in depth throughout the data set, except Nov 1997 – Feb 1998 when depth fluctuations were 1.2 to 1.7 m. Harmonic regression analysis attributed 45% of depth variance to interaction between 12.42 hour and 24 hour cycles, 24% of variance to 24 hour cycles, and 31% of variance to 12.42 hour cycles.

Thirty-eight percent of water temperature data in 1997 and 85% of annual water temperature data in 1998 were included in analyses. Mean water temperature followed a seasonal cycle, with mean water temperatures 13-16°C in fall/winter and 23-25°C in summer (Figure 37). Minimum and maximum water temperatures were 7.5°C (Dec 1998) and 32.1°C (Apr-May 1998), respectively. Scatter plots suggest strong fluctuations (4-10°C, occasionally >10°C) in daily and bi-weekly water temperature throughout the data set, with strongest variation in spring and summer. Harmonic regression analysis attributed 59% of water temperature variance to interaction between 12.42 hour and 24 hour cycles, 30% of temperature variance to 24 hour cycles, and 11% of temperature variance to 12.42 hour cycles.

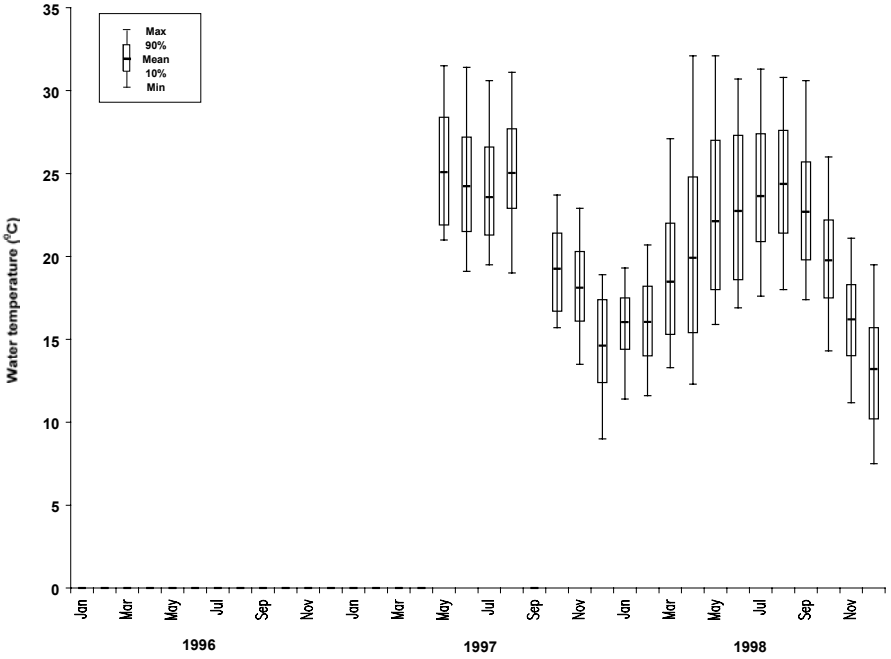


Figure 37. Water temperature statistics at Tidal Linkage, 1996-1998.

Thirty-eight percent of annual salinity data in 1997 and 81% of annual salinity data in 1998 were included in analyses. Mean salinity was 25-31 ppt throughout the data set, except between Feb-May 1998 when mean salinity was 13-22 ppt (Figure 38). Minimum and maximum salinity between May 1997 and Dec 1998 was 0.4 ppt (Feb 1998) and 35.2 ppt (Jun 1998), respectively. Scatter plots suggest moderate fluctuations (≤ 5 ppt) in daily and bi-weekly salinity between May-Nov 1997, strong fluctuations (≤ 10 ppt) between Jun-Dec 1998, and strongest fluctuations (10-25 ppt) during episodic events in Dec 1997 and Feb-May 1998. Harmonic regression analysis attributed 59% of salinity variance to interaction between 12.42 hour and 24 hour cycles, 24% of salinity variance to 24 hour cycles, and 17% of salinity variance to 12.42 hour cycles.

Thirty-eight percent of dissolved oxygen (% saturation) data in 1997 and 80% of DO data in 1998 were included in analyses. Mean DO ranged from 38-96% saturation. Mean DO followed a seasonal cycle; however, very large variances (> 250%) were associated with mean DO in May-Jun 1997 and most of 1998. Mean DO was 84-96% saturation between Oct 1997 – Apr 1998 (except Feb 1998) and 38-77% saturation otherwise. Minimum and maximum DO was 0.2% saturation (Apr 1998) and 462% saturation (Apr 1998), respectively. Hypoxia was observed in May-Aug 1997, Jan 1998, and Apr-Nov 1998 and, when present, hypoxia persisted for 24.8% of the first 48 hours post-deployment

on average (Figure 39). Supersaturation was observed during every month with data between May 1997 and Nov 1998 and, when present, supersaturation persisted for 19.2% of the first 48 hours post-deployment on average. Scatter plots suggest strong fluctuations (80-100%) in percent saturation throughout the data set, with strongest fluctuations (> 250%) observed during episodic events in Jun-Aug 1997 and Apr-Oct 1998. Harmonic regression analysis attributed 57% of DO variance to interaction between 12.42 hour and 24 hour cycles, 35% of variance to 24 hour cycles, and 8% of variance to 12.42 hour cycles.

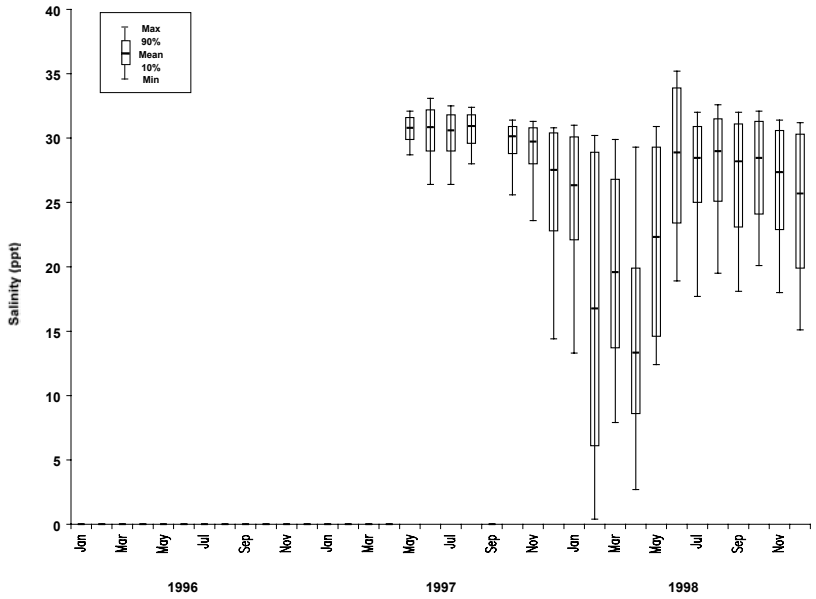


Figure 38. Salinity statistics at Tidal Linkage, 1996-1998.

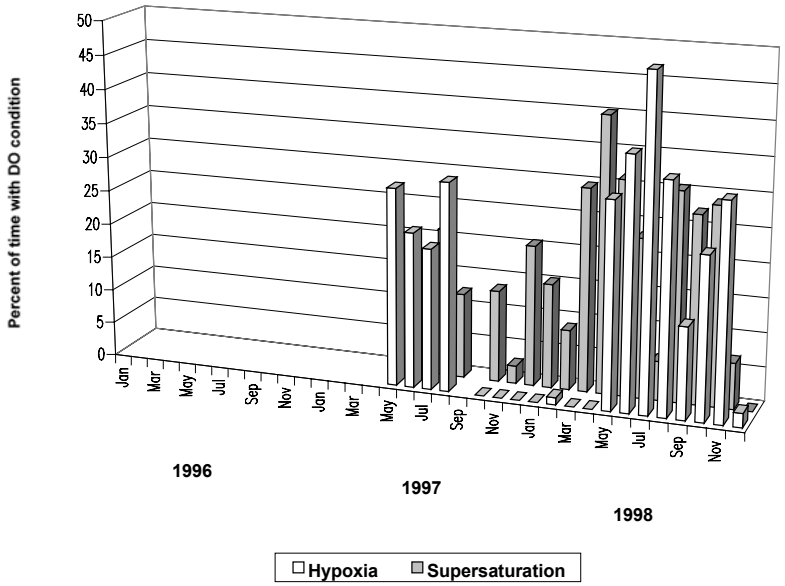


Figure 39. Dissolved oxygen extremes at Tidal Linkage, 1996-1998.